PATENT SPECIFICATION 966,565

DRAWINGS ATTACHED.

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966,565

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International Classification :—**B 23 b** (B 23 c, g, F 06 h).

COMPLETE SPECIFICATION.

Machine Tools.

We, THE WAVIS ENGINEERING DEVELOPMENT CO. LIMITED, of Highlands Road, Shirley, in the County of Warwick, a Company incorporated under the Laws of the United Kingdom of Great Britain and Northern Ireland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention has reference to machine tools and is concerned particularly with machine tools of the kind known as "screw feed unit heads" and which are employed for drilling, reaming, spot facing, tapping, boring, milling and like operations.

The present invention has for its object to provide a machine tool of the kind aforesaid which is simple in construction and in its manner of operation and which requires a minimum of maintenance.

Accordingly the invention consists of a machine tool of the kind hereinbefore referred to in which a spindle for driving the tool and a feed nut which co-operates with a lead screw for occasioning the feeding of the tool are each adapted to be driven by a separate electric motor and in which the rotor shafts of the two electric motors are coupled and in which provision is made for driving the said driving spindle and feed nut at differential speeds.

The invention also resides in a machine tool of the kind hereinbefore referred to and as aforesaid in which the manner of coupling the rotor shafts of the two electric motors is such that during the driving of the tool the surplus power available in the motor for driving the feed nut may be employed to assist in driving the tool.

The invention further resides in machine tools constructed, arranged and adapted for use substantially as will be described hereinafter.

An embodiment of the invention will now be described with particular reference to the accompanying drawings in which:—

Figure 1 is a side elevation of a screw feed unit head constructed in accordance with the invention;

Figure 2 is a longitudinal vertical section on substantially the centre line of the unit head illustrated in Figure 1;

Figure 3 is a fragmentary view in transverse section the section being taken on the plane indicated by the line 3—3 in Figure 2 looking in the direction of the arrow of the said line; and

Figure 4 is a fragmentary view in transverse section and on an enlarged scale the section being taken on the plane indicated by the line 4—4 in Figure 2 looking in the direction of the arrow to the said line.

In the drawings like numerals of reference indicate similar parts in the several views.

According to the illustrated embodiment of the invention the screw feed unit head incorporates a base 10 upon an intermediate portion of which is turnably mounted in a manner to be described hereinafter the rear part 121 of a two part driving spindle designated generically by the reference numeral 12. The front end of the said rear part 121 is pinned to the rear end of the forepart 122 of the driving spindle 12.

The forepart 122 of the driving spindle 12 is turnably mounted in ball bearings 131 carried by a sleeve 13 which is longitudinally displaceable within a bore in the forepart of the base 10 said forepart 122 of the driv-

ing spindle 12 being adapted to have a tool (not shown) mounted on the projecting end thereof in known manner.

The sleeve 13 has bolted thereto a casing 14 which is axially displaceable with the sleeve 13 and with the forepart 122 of the driving spindle 12 as the tool is fed forward in a manner to be described hereinafter.

The rear part 121 of the driving spindle 12 is splined as at 123 and is axially slidable through the medium of said splines within complementary slots formed in the wall of a central bore formed in sleeve 15 which is turnably mounted in ball bearings 151 said ball bearings 151 serving as a support for the front portion of the rear part 121 of the driving spindle 12.

Keyed to the sleeve 15 is a pulley 17 which is adapted to be driven through the medium of an endless belt 18 from a driving pulley 191 fixed on the projecting end of the horizontally disposed rotor shaft 192 of an electric motor 19 hereinafter termed the spindle electric motor 19.

The belt 18 co-operates with a jockey pulley 181 having eccentric adjustment means see Figure 3 for maintaining the tensioning of the driving belt 18.

Concentrically mounted around but spaced from the rear end portion of the rear part 121 of the driving spindle 12 is a sleeve 20 having a rearwardly projecting portion which is rotatably mounted in ball bearings 201 supported from the base 10.

Keyed to the forepart of the sleeve 20 is a gear wheel 21 which meshes with an intermediate gear wheel 22 to which is fixed a complementary gear wheel 23 the teeth of which mesh with the teeth of a driving gear wheel 241 mounted on the horizontally disposed rotor shaft 242 of a second electric motor 24 hereinafter termed the feed motor 24.

The rotor shaft 242 of the feed motor 24 is coaxial with the rotor shaft 192 of the spindle driving motor 19 and the said two rotor shafts 242 and 192 are coupled through a clutch 25 conveniently a magnetic clutch so that the two motors 19 and 24 must always be in synchrony.

Bolted to the rear portion of the sleeve 20 is a feed nut 26 the screw thread of which meshes with the screw thread of a lead screw 27 arranged coaxially with the driving spindle 12 and associated in driving relationship therewith by means of a pin 271 and slot 272 said pin and slot method of connection being itself known.

The lead screw 27 is screw-threaded in an opposite hand to the direction of rotation required to be imparted to the driving spindle 12. Thus if the driving spindle 12 is to be rotated in an anti-clockwise direction when viewed from the front the lead screw 27 is given a left-hand thread.

Fixed to the forepart 122 of the driving spindle 12 and projecting laterally therefrom is a pin 28 which carries a depending arm 29 to the lower end of which is bolted the forward end of a horizontally arranged rod 30 which is axially slidable within bearings supported by the base 10.

Adjustably mounted on the said rod 30 are three trip members 310, 311 and 312 respectively which co-operate with the noses of plungers 320, 321, 322 see Figures 2 and 4 for tripping micro switches 33 of known construction two of which are seen in Figure 4 for controlling the electric circuits incorporating the spindle motor 19 and the feed motor 24.

The master electric circuit is under the control of a push-button remote controlled unit of known construction.

The driving ratio between the spindle motor 19 and the sleeve 15 and hence of the driving spindle 12 and the driving ratio between the feed motor 24 and the feed nut 26 are arranged to be slightly different so that the feed nut 26 will be driven at a slightly faster rate than the driving spindle 12.

The whole unit is enclosed within a detachable casing 34.

The screw feed head unit hereinbefore described is adapted for operation as follows:—

Assuming a drilling operation is to be performed the drill is attached to the forward end of the forepart 122 of the driving spindle 12 in the conventional manner whereupon the push-button control is actuated to occasion the completion of the circuit through the feed motor 24 whereby the feed nut 26 is rotated and thereby in co-operation with the lead screw 27 caused to effect a rapid approach of the drill to the work. When the drill comes into close proximity to the work the trip member 310 associated with the rod 30 which is movable with the driving spindle 12 coacts with the plunger 320 associated with contact making means of the relevant microswitch 33 to complete the electric circuit through the spindle motor 19 whereby the said motor 19 comes into operation to effect rotation of the driving spindle 21 and hence of the drill and since the feed nut 26 rotates faster than the spindle motor 19 the feed nut 26 continues to feed the drill forwardly at a predetermined speed.

When drilling has been completed the second trip member 311 coacts with the associated contact making means of the relevant micro-switch 33 to effect the stoppage of the feed motor 24 whilst leaving the spindle motor 19 in operation so that the driving spindle 12 and the lead screw 27 continue to rotate. Hence since the lead

screw 27 is of opposite hand to the direction of drive imparted to the driving spindle 12 the co-operation between the lead screw 27 and the now stationary feed nut 26 occasions a rapid "return" of the driving spindle 12.

When the driving spindle 12 has been returned to the full return position the third trip member 312 occasions through the appropriate micro-switch 33 the cutting out of the spindle motor 19 whereupon the unit is ready for a repeat of the cycle.

It will be appreciated that since the feed screw 26 does not require so much power as the spindle 12 the clutch 25 coupling the two motors 19, 24 when both motors 19, 24 are in operation permits the surplus power not required by the feed screw 26 to be transmitted to the spindle motor 19 thereby providing supplementary power for the machining operation.

If desired instead of employing belt drive for the driving spindle 12 the drive may be transmitted from the spindle motor 19 to the driving spindle 12 through toothed gearing and likewise the drive from the feed motor 24 to the sleeve 20 may be through the medium of a belt drive.

Further it will be appreciated that either with driving belt drive or with toothed gearing provision may be made for varying the driving ratio as may be required.

Moreover it will be appreciated that although the invention has been described as applied to a screw feed unit head for drilling such units may be employed for reaming, spot-facing, tapping, boring, milling and the like operations.

In addition it will be appreciated that a screw feed unit head constructed as hereinbefore described is compact, simple in construction and in its manner of operation and reliable in use since there are few components or parts which may give rise to failure and the switching arrangements make use of components of proved reliability.

WHAT WE CLAIM IS:—

1. A machine tool of the kind hereinbefore referred to in which a spindle for driving the tool and a feed nut which co-operates with a lead screw for occasioning the feeding of the tool are each adapted to be driven by a separate electric motor and in which the rotor shafts of the two electric motors are coupled and in which provision is made for driving the said driving spindle and feed nut at differential speeds.

2. A machine tool as claimed in Claim 1 in which the manner of coupling the rotor shafts of the two electric motors is such that during the driving of the tool the surplus power available in the motor for driving the feed nut may be employed to assist in driving the tool.

3. A machine tool as claimed in Claim 1 or Claim 2 in which the respective driving ratios are such that the feed nut is adapted to be rotated at a faster rate than the driving spindle.

4. A machine tool as claimed in any one of the preceding claims in which there is traversible with the driving spindle a member having trip members adjustably mounted thereon and in which the said trip members co-operate with micro-switches for successively occasioning the bringing into operation the electric motor for driving the driving spindle, the cutting out of the motor for driving the feed screw when work has been completed and for cutting out the electric motor for driving the driving spindle when the spindle has been withdrawn to its initial position after completion of the work.

5. A machine tool as claimed in any one of the preceding claims in which the drives from the electric motors to the spindle and feed screw may be effected through the medium of belt drive or through the medium of toothed gearing or through the medium of combinations of belt drive and toothed gearing.

6. A machine tool as claimed in any one of the preceding claims in which provision is made for varying the driving ratios as may be required.

7. A machine tool as claimed in any of the preceding claims in which the rotor shafts of the two electric motors are arranged coaxially and coupled by means of a clutch.

8. A machine tool as claimed in Claim 7 in which the clutch is a magnetic clutch.

9. A screw feed unit head constructed arranged and adapted for use substantially as described herein and illustrated in the accompanying drawings.

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FIG.1.

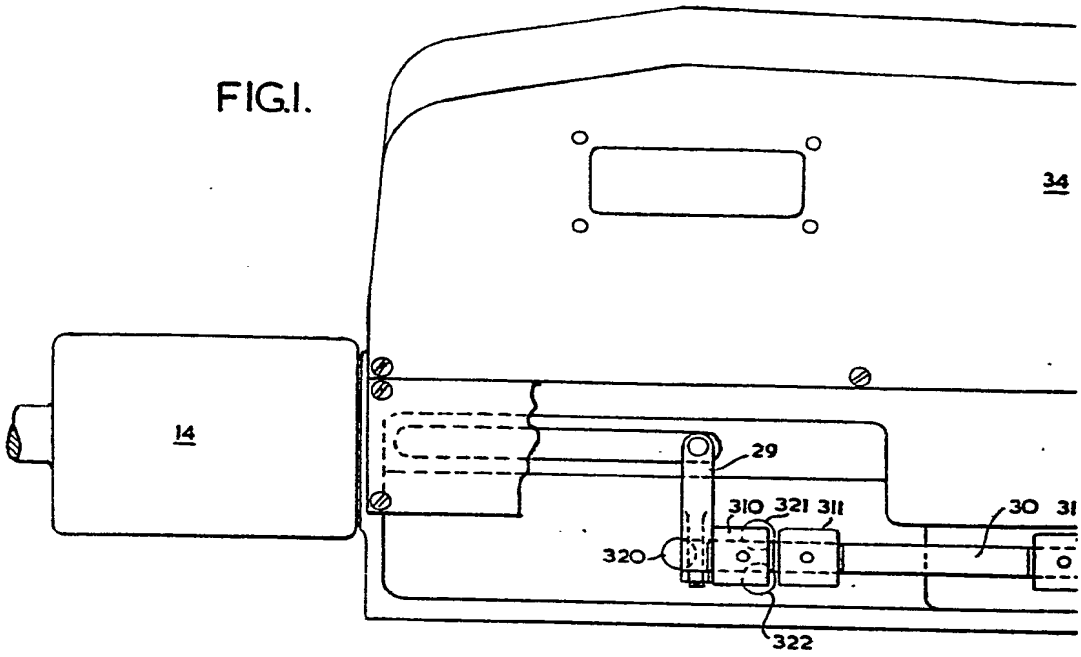
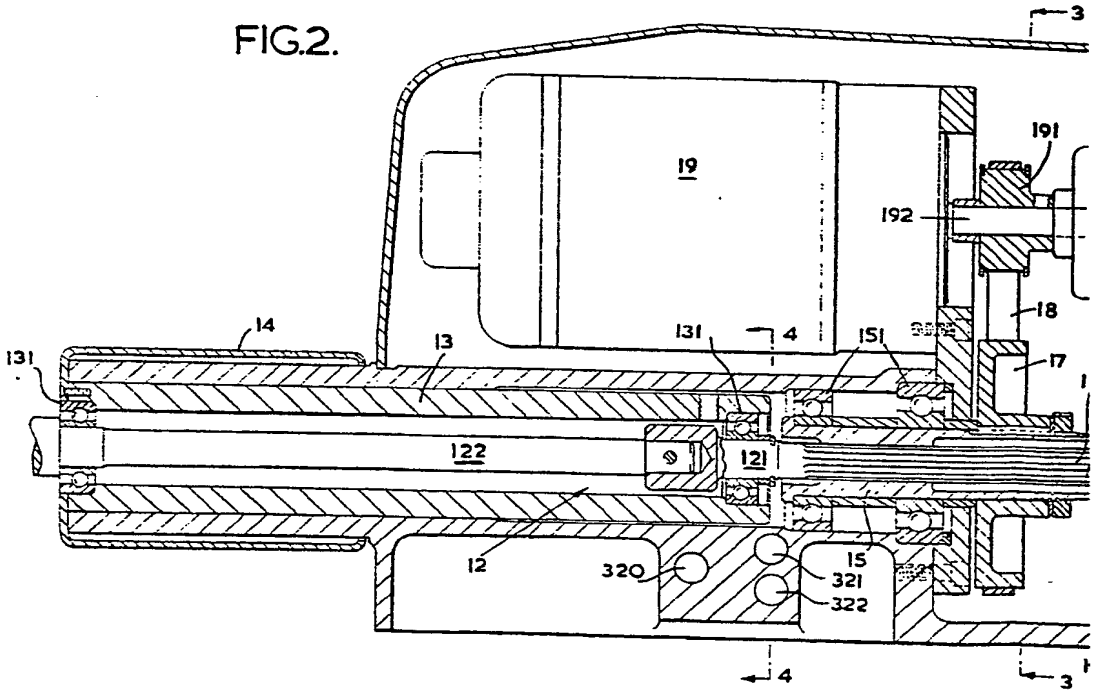


FIG.2.



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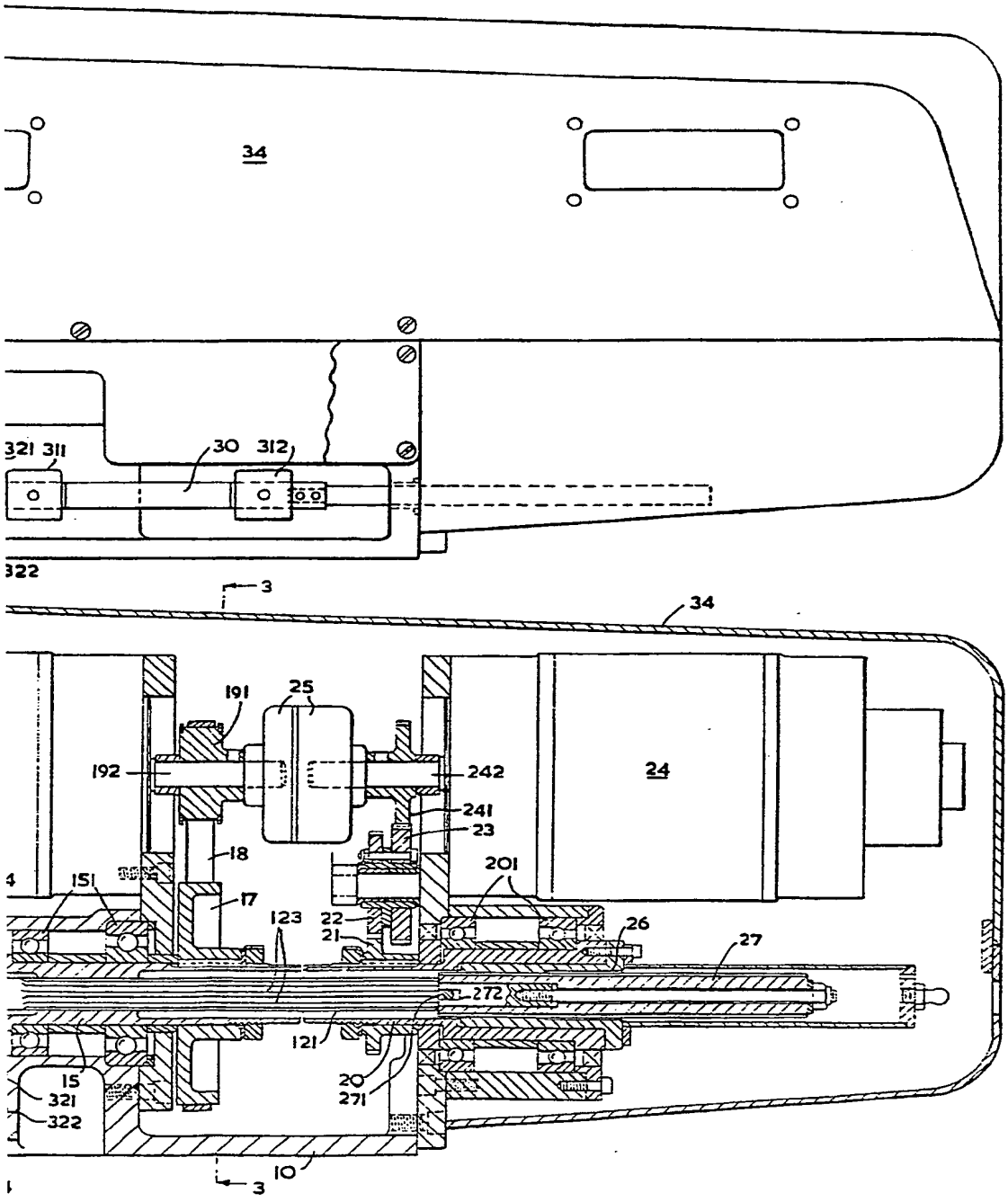
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1



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2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 1

FIG.1.

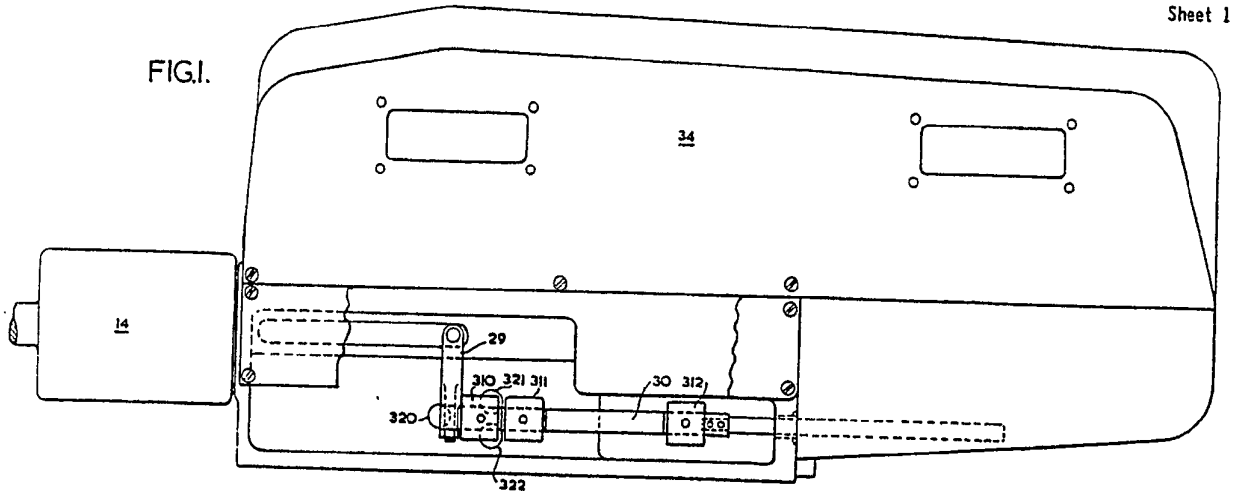


FIG.2.

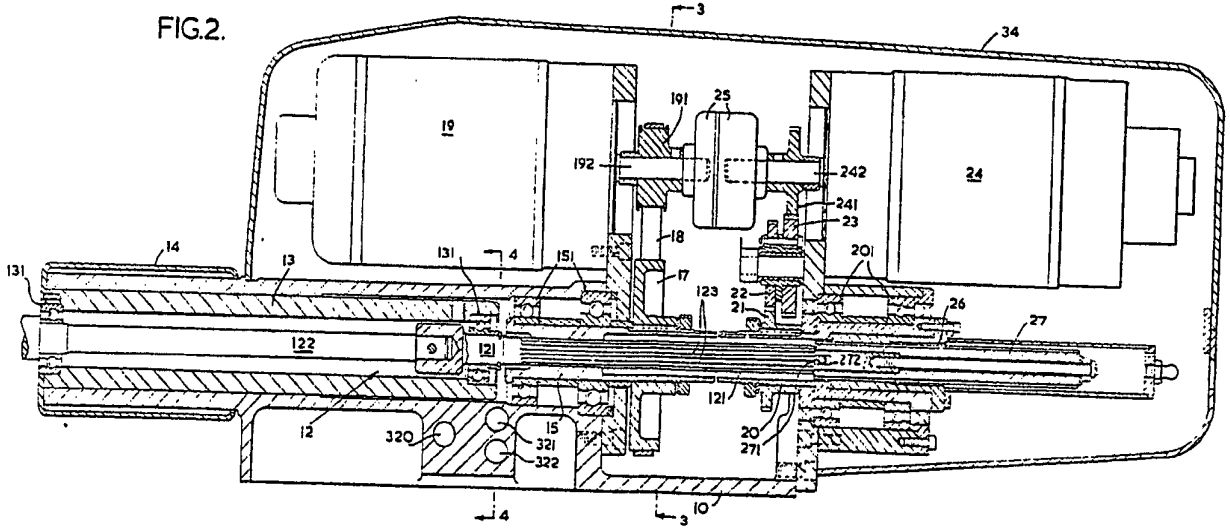


FIG.3.

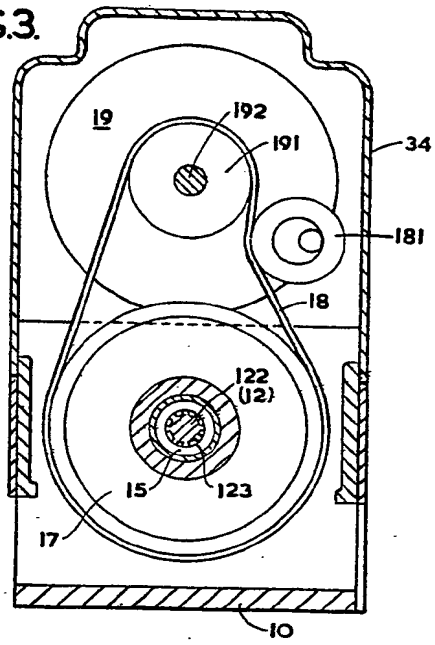
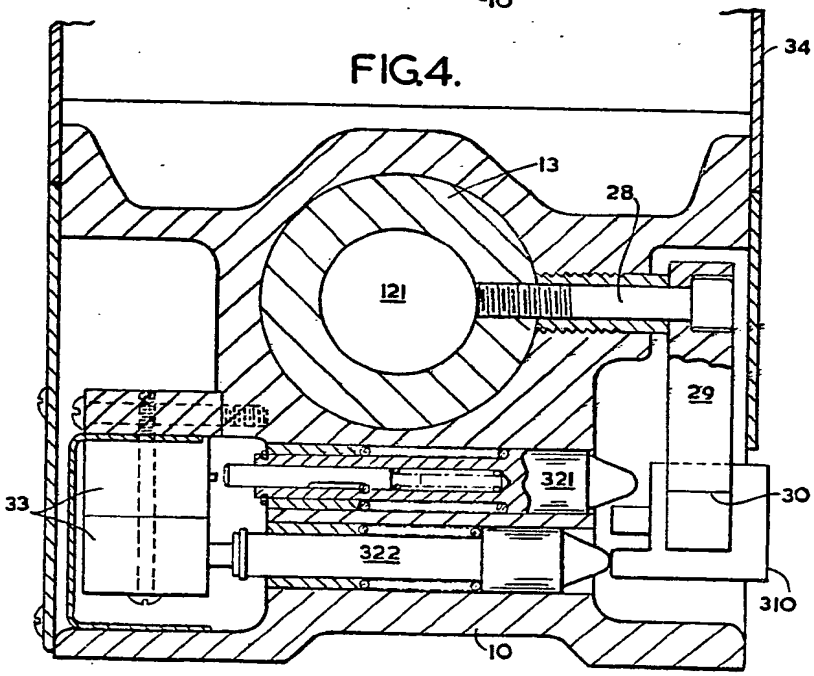


FIG.4.



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